

# SUSTAINABLE LIVELIHOOD AND ENTERPRISE DEVELOPMENT OF TILAPIA PROCESSING AT PATITINAN, SAGÑAY CAMARINES SUR, PHILIPPINES: An Extension Services Project

Myrna C. Bigueja<sup>1</sup>, Glenda S. Sales<sup>2</sup>, Irene P. Daet<sup>3</sup>, and Luisa M. Lanciso<sup>4</sup>

<sup>1,2,3</sup>Partido State University Sagnay, Campus, Nato Sagnay, Camarines Sur

<sup>4</sup>Partido State University, Goa, Camarines Sur

Corresponding author: Myrna C. Bigueja

## ABSTRACT

The project aims to improve the socio-economic well-being of the beneficiaries and train them on tilapia processing, capacitate marketing and enterprise-based product, establish and operate tilapia-based product enterprises in patitinan, Sagnay, Camarines Sur. The success of the implementation of the project **Memorandum of Agreement** between the Partido State University (PSU) and Barangay Patitinan, Sagnay, Camarines Sur, Philippines was initiated. The services were implemented geared towards the nation's goals of self-sufficiency in Small Business Enterprise through effective management of the project. The project was effectively fulfilled due the effort of the Project Monitoring Team (PMT) of the university. Likewise, the proponent with the help of the barangay council monitored the enterprises every month to evaluate the enterprise. The beneficiaries are the vulnerable individual from poor families in Patitinan, Sagnay, Camarines Sur who are members of the 'Pantawid Pamilyang Pilipino Program' (4Ps) and those who do not have any support and training skills such as: widows, orphans, and out-school-youth. Twenty (20) individuals were selected and were trained for 20 days for different tilapia products and other value-added products. They were also trained for 10 days on costing and pricing, packaging and labelling, packaging design development, good manufacturing processes, basic knowledge on establishing small business enterprise, marketing strategies, simple preparation project proposal and work values. After the training the participants were given a starter kit of tools, utensils, and equipment which are used by beneficiaries in their own small business enterprise. Lastly, the beneficiaries of this project are committed to help improve their lives by applying the knowledge and skill they learned from training through carefully managing their home-based enterprise

**KEYWORDS** - Sustainable, Livelihood, Enterprise, Development, Tilapia, Product

## 1. INTRODUCTION

The full year 2015 poverty incidence among the population, or the proportion of poor Filipinos, was estimated at 23.3 percent. This translates to 23.5 million Filipinos (from 21.9 million) who lived below the poverty threshold (PSA, 2015)<sup>[1]</sup>. Unemployment is one of the major concerns of local government units. Over the years, the fast rising increase in population has created poverty everywhere most especially in the depressed area. Non-Government Organization, Peoples Organization, through the help of financial institutions and experts in sustainable development often tried to initiate livelihood projects and programs but only a small percentage succeeded. Mostly, the cause of failure of projects and programs was the marketing aspect.

They taught how to do and produce but they disregarded the concept of how and where to sell the produced products. Various government units, agencies, civic and business organizations have continued to initiate steps to solve the ever-growing problems of accumulation. Hence, this report purposely shared the experiences of the faculty extensionist of Partido State University, Camarines Sur, Philippines in transferring the technologies on processing tilapia and sharing their knowledge on how to sustain the livelihood of the recipient to improve their way of living.

Sagñay is located in the eastern portion of Camarines Sur, facing the coastal waters of Lagonoy Gulf. The Municipality comprises 7 coastal barangays such as: Nato, Sto. Niño, Turague, Sibaguan, Bongalon, Patitinan and the Island of Atulayan. In these barangays the only source of livelihood of the people is fishing and farming. Patitinan Sagnay coastal is rich Marine, freshwater fishery products. The mayor of the town constructed 3 hectares of fishpond intended for tilapia culture. However, most of the inhabitant are lack of knowledge in preserving the tilapia and other processed so that this will be preserve and be there source income and at the same improving their lives.

Several innovation and intervention to improve the processing of tilapia into safe and quality products has been conducted by the researcher, In 2014 & 2015, the process of bottled tilapia and cocosauce and Smoking Indian Mackerel (*Rastrelliger Kanagurta*) Using Bagasse as Flavor Enhancer was granted Intellectual Property Rights as Utility Model to the researcher respectively. Furthermore, microbial safety and quality of Vacuum Packed (VP) hot-processed filleted smoke flavored Nile Tilapia (*Oreochromis niloticus*) in different moisture content at various time and temperature were examined and was found acceptable to the consumer (Bigueja, et.al., 2021)<sup>[2]</sup>. Therefore, it is just necessary that results of research should be transferred to the community and commercialized to uplift the lives of people living in the community. Republic ACT No. 10055, Philippines, sec. 2 stated that “The State shall facilitate the transfer and promote the utilization of intellectual property for the national benefit and. shall call upon all research and development institutes and/or institutions (RDIs) that perform government-funded research and development (R&D) to take on technology transfer as their strategic mission and to effectively translate results of government-funded R&D into useful products and services that will redound to the benefit of Filipinos, notwithstanding the income generated from intellectual property rights (IPRs) and technology transfer activities” Hence, this community service was conducted in Patitinan, Sagñay, Philippines not only to teach them the proper way of processing tilapia but also help them start a small enterprise for them to have a continuous livelihood income.

On a global basis, tilapia (*Oreochromis niloticus*) is one of the most important species in aquaculture because of its genetic, reproductive, and marketing characteristics. Tilapia is a popular freshwater fish due to their nutritional benefits and wide availability. Intensive tilapia farming in Asia has increased steadily and become an important source of fish within the last few years (Murthy et al., 2011 cited by Bigueja, et.al., 2021)<sup>[3,2]</sup>.

The Tilapia production in Bicol Regin, Philippines is increasing annually. It is now one of the major species produced in aquaculture in Bicol, Philippines. The increase in supply resulted to a continuous drop in its price. This necessitates the industry to diversify to processing. Currently, tilapia is usually consumed as fresh and only small amount of the total supply is processed into different products. Employing appropriate processing technology and developing value-added products from tilapia is therefore necessary to increase economic returns from tilapia production and processing and likewise reduce post- harvest losses. Moreover, it is but timely to develop value-added products with the increasing consumer preference on these commodities. Ready to cook fishery products are also becoming in demand nowadays.

Tilapia is commonly marketed live in Bicol from some municipal markets, while fresh bundles and farm gate sales are also practiced. Frozen tilapia is also being sold but limited. Value-adding has been conducted on an experimental basis by Partido State University like bottled tilapia and smoked tilapia but this product has not been commercialized in large scale due to the technology product has not been transferred to Small and Medium Enterprise. Hence, this project.

According to urban and rural sociology expert Christoplos, I., et.al., 2019<sup>[4]</sup> stated that extension includes “all the different activities that provide the information and services needed and demanded by farmers and other actors in rural settings to assist them in developing their own technical, organizational and management skills and practices so as to improve their livelihoods and well-being.” In this report

The project aims to establish strong linkage on tilapia processed and marketing through extension services of the Partido State University. The fisher’s folks particularly women patitinan which was organized and provided with proper trainings on the different tilapia processed products, valued added products, market information and market linkages. The actual processing of the tilapia was properly programmed and facilitated by the proponents. The project generated new information, capacitated, and developed products that establish home-based tilapia products enterprises for fisher wives in Patitinan which are now their source of their additional income. Presently, the enterprise has now producing tilapia products particularly the tillangit and smoke tilapia.

## 2. METHODOLOGY AND ACTIVITIES

### 3.1 Training area



**Figure 1. Map of the Study Area**

Fig. 1 Shows the training Area, the Barangay Patitinan of Sagñay Camarines Sur, Philippines. The area is rich in inland and marine fisheries but due to lack of knowledge both on aquaculture and post –harvest most of the inhabitants in this place they focus on farming as their livelihood. Hence, this project was conducted in this place to develop their understanding on post-harvest fishery and be one of their sources of additional income especially if it is not harvesting time of their crop in the farm.

### 3.2 Process

These extension services were conducted for one year including the training of 20 days processing tilapia products, 10 days for on costing and pricing, packaging and labelling, packaging design development, good manufacturing processes, basic knowledge on establishing small business enterprise, marketing strategies, simple preparation project proposal and work values. After the training beneficiaries were encouraged and directed to establish small and Medium Enterprise (SME) by seeking financial aid from the Local Government (LGU), Department of trade and industry (DTI), Bureau of fisheries and aquatic resources (BFAR) and Department of Science and Technology (DOST) these are key stakeholder that can help to sustained the projects. Monitoring of the project was done every month by the Project Monitoring Team (PMT) of the university to meet scientifically the target of the project. According Fujita, R., et. Al., 2018 [5] Managing fisheries such that they reach the potential can be a key approach for achieving many of the United Nations Sustainable Development Goals: ending poverty and hunger, protecting vulnerable populations, creating sustainable livelihoods and protecting ocean ecosystems. One of the key barriers to achieving this potential is the widespread lack of fisheries monitoring. Improving fishery performance with respect to seafood production, profits, livelihoods and conservation will require that more fisheries are monitored, scientifically assessed and managed based on data and science. In this context it is necessary that every project must be monitored.

Upon the approval of the proposal the selection of the beneficiaries was conducted by the Patitinan Barangay Council. The beneficiaries focused on the Sustainable Livelihood and Enterprise Development of Tilapia Processing.

The proponents of the project created a monitoring team and conducted monitoring visits in coordination with the Patitinan Barangay Council. Linkage with other government and non-government agencies was sought for by Proponents to source out other forms of assistance which provided to the identified beneficiaries enhancing their knowledge and skill and further created their own livelihood sure of incomes. A **Memorandum of Agreement** between the Partido State University (ParSU) and Barangay Patitinan was done before the start of extension activities. Before the start of the activities booklet and other references were prepared and pre-test and post were conducted

### 3.2 Activities

The activities were started with the Orientation to the participant about the project. There were three important activities conducted, First, the transfer of technology on the different products of tilapia and training on the basic knowledge of entrepreneurship; second, the training on financial literacy, marketing strategies and values formation; the third one is monitoring activities which include the organization of groups. Before the start of the training profiling of the recipients of the project was conducted. During the training it started with the pre-test to determine if the participants had existing knowledge on processing tilapia, on the basic knowledge of entrepreneurship and financial literacy. This training serves as a medium of technology transfer to disseminate the technology to the fishers as well to industry.

After the training the participants were given a starter kit in the form of processing equipment and tools which were used by the individual in their own small business enterprise. Monitoring was conducted every month to check the success of the small business **enterprise** created by the group.

## 3. RESULTS AND FINDINGS

### 3.1 Profile of the Recipients of the project

Table 1. Shows the profile of the participants. These were selected to the recommendation of the Department Social Welfare and Development (DSWD). The beneficiaries are the vulnerable individual from poor families in Patitinan, Sagnay, Camarines Sur who are members of the ‘Pantawid Pamilyang Pilipino Program’ (4Ps) and those who do not have any support and training skills such as: widows, orphans, and out-school-youth. Twenty (20) individual were selected and were trained for 20 days for different tilapia products and other value-added products. They were also trained for 10 days on costing and pricing, packaging and labelling, packaging design development, good manufacturing processes, basic knowledge on establishing small business enterprise, marketing strategies, simple preparation project proposal and work values. These individuals are most necessary to be trained because they belong below the poverty line. Since this is focused on post-harvest majority of the participants are married and female. These were usually the house wives who were 40 years old and above. One of the significant findings was that 60% of these women are still living with their family.

Similarly, Labayo, C.P. and Preña, E. M., (2021) <sup>[6]</sup> in their study Socioeconomic Conditions of Coastal Communities Along Albay Gulf, Bicol Region, Philippines found out that 39% of households had married members but were still living with their parents. This means that the extended family is still common in fishing communities wherein aside from the mother, father, and their children, the spouses, as well as the sons and daughters of their children, are also living in the same household. Furthermore, these women were only domestic activities wherein they were not allowed to go fishing and farming. Similar observations were shared by Ahmed, M. et. al., (2021) <sup>[7]</sup> that women were engaged in domestic activities and were not allowed to go out for large-scale fishing due to social and security problems. However, due to the economic problem they encountered they need to engage in other activities that can support daily needs and to the education of their children. Medard, M., 2004 and Onyango, P.O. et.al., 2006) <sup>[8,9]</sup> reported that the fishers engage in other income generating activities to meet their daily needs and to subsidies on their income. The main activities that the fishers are involved in to supplement their income are farming of both cash and food crops, livestock keeping (cows, sheep, goats), petty businesses such as food kiosks. The Technology, knowledge and skill that were shared to them by the group of trainers or educators to the participants in this project develop their capability to engage in business to support their husband to have additional income in the family.

**TABLE 1. The Profile of the Recipients in Terms of Sex, Civil Status, Age and Highest Educational Attainment**

Profile	Total	Percentage
<b>Sex</b>		
Male	4	20%
Female	16	80%
<b>Total</b>	<b>20</b>	<b>100%</b>
<b>Civil Status</b>		
Single	3	15%
Married	15	75%
Separated	1	5%
Widow	1	5%
<b>Total</b>	<b>20</b>	<b>100%</b>
<b>Age</b>		
20-24	1	5%
25-29	2	10%
30-34	3	15%
35-39	3	15%
40 Above	11	55%
<b>Total</b>	<b>20</b>	<b>100%</b>
<b>Highest Educational Attainment</b>		0%
Elementary Graduate	12	60%
High School Graduate	6	30%
College Under Graduate	2	10%
<b>Total</b>	<b>20</b>	100%
<b>Occupation:</b>		0%
Fishermen	5	25%
Farmers	4	20%
Non-Government Employee	1	5%
Housewives/husband	10	50%
<b>Total</b>	<b>20</b>	100%

### 3.2. Most Significant Change

By improving the governance and management of fisheries, aquaculture development and processing tilapia, can improve food security, social benefits, regional trade and increase economic growth, while also ensuring the protection of fishery resources and both marine and freshwater ecosystems.

#### 3.2.1 Impact of the Application of Fish processing technology

##### 3.2.1.1 Technology practiced by the respondents before and after training

The participants were asked regarding the technology practiced in postharvest handling of Tilapia before the training. It was revealed by 100% of participants that when harvesting the tilapia, the fish will just be put in an ordinary plastic container with water and brought to the market or sold to the nearby barangay. The participants said they have any other technology or processing method to control the deterioration of the fish, if the fish were not totally sold, they cooked and fed them to their children. About 90% of the participants did not practice sorting, grading, washing and chilling Tilapia before training but after receiving training 100% respondents followed the correct process were the fish were sorted, graded, washed and chilled before bringing it to the market or selling to the nearby barangay. The participants give the reason why the fish need to be cleaned, washed and chilled. As stated Nowsad, AKM, A. (2013)<sup>[10]</sup> that Fish is one of the most rapidly perishable items in nature. It undergoes spoilage very fast as soon as harvested, if not treated adequately. Fish live in water. There are millions of very small organisms, called bacteria, in the water that can come in direct contact with fish. Bacteria cannot spoil fish if they do not get an adequate environment. Bacteria like warm temperatures: not too cold and not too hot. This knowledge was learned by the participants during training and was applied in reality.



### 3.2.1.2 Tilapia Processing Technologies Transferred to the Participants

The participants were trained on the different food products that can be made out of their harvested tilapia and be their sustainable livelihood. Figure 2 shows the different products that were developed by the participants with the aid of their trainers. After learning the different technologies on processing and preserving tilapia the participants were also trained how to establish small business enterprises. The participants were organized as a group of fish processors of tilapia so that it is easy for them to access financial assistance from the local government.



**Bottled Tilapia.** This bottled tilapia is named Cocolapia, this is a newly developed product, a research output from tilapia pack with coco sauce (Bigueja, et. al. 2020) <sup>[11]</sup>, this technology was granted by intellectual Property Rights as utility model last 2015 and now was extended to fisherfolks to be their sustainable livelihood and source income.

**Smoked Tilapia.** Fish smoking is not practiced throughout the country and many coastal areas prefer to dry or ferment excess fish than to smoke them (Mendoza, 1986 cited by Guevara, G. and Camu, C., (1988) <sup>[12]</sup>. However, in Camarines Sur, Philippines Smoked fish locally known as “tinapa” is the most favourite fish product that is added to cooking vegetables. Although the common fish that smoked are tuna, sardines, mackerel and round scad fish. In this project tilapia was used. Bigueja, et.al., (2021) <sup>[13]</sup> noted that the most favourable smoked tilapia was the product stored at refrigerated temperature (4<sup>0</sup>C) with 20% moisture content and the most acceptable products for panellists. Hence, smoked is also a good product as long as it's refrigerated at 4<sup>0</sup>C is not to be eaten.

**Tilapia Tocino.** Tilapia were prepared into fillet and were cured by soaking in pickling solutions overnight and vacuumed packed and kept in refrigerated temperature (0<sup>0</sup>C). Dalaguit, M. and Dalaguit, A., (2016) <sup>[14]</sup> evaluated several treatment of processing tilapia tocino, they concluded that tilapia meat was generally acceptable as main ingredients in tocino preparation and the recipe is highly recommended for entrepreneurial venture through technology transfer.

**Marinated Tilapia.** Marinating Tilapia was done by dipping the fish fillets into solutions containing acetic acid and NaCl, packed in a container and stored at room temperature (25°C). Ahmed, O., (2015) <sup>[15]</sup> concluded that warm marinated tilapia could be consumed safely throughout the first week from storage period while the cold marinated tilapia (*Oreochromis niloticus*) fillet could be stored safely for up to 42 days. Hence marinating tilapia can be a good entrepreneurial activity to earn additional income.

**Tilanggit (Dried Tilapia).** The 2-month old tilapia were used for tilanggit production. The fish is split and soaking in a brine solution for 1 hour and dried until it reaches 20% moisture content. Tilanggit is the local in the Philippines for dried tilapia that are sold in the market. Tilanggit is a dried tilapia product well-known for its taste and crunchiness, meatier, tastier and crunchier than any dried fish product (Roxas, P.t.al, 2018) <sup>[16]</sup>.

**CASTIL (Tilapia Cracker).** CASTIL is a newly developed product from Tilapia. CASTIL is a Cracker made from cassava (*Manihot esculenta*) pulp and flavoured with Nile Tilapia (*Oreochromis niloticus*) powder. The following ingredients are also used: the vanilla, oil, salt, and food colouring. Tilapia flour will serve as the flavouring agent in the product that will enhance the product in terms of taste and its nutritional aspect, the vanilla oil improves the aroma of the product because this will lessen the fishiness of the product while the food coloring enhances the appearance of the product. The basic process of making CASTIL Cracker involves washing and cleaning of cassava followed by grating of cassava and squeezing in order to lessen the moisture content of cassava. For the tilapia powder it will undergo lowering of moisture content through putting it into the oven for 30 minutes and next is pulverizing the dried tilapia. After preparing the Cassava pulp and powder it will be followed by mixing all the ingredients and pouring and flattening the mixture in banana leaves and cooking in boiling water of the prepared mixture of the combined ingredients, followed by sun drying to remove the moisture content, cutting to desired size and deep frying.

### 3.2.2 Training Business Skills & Entrepreneurship Development

The Training for the Business Skill & Entrepreneurship Development is intended to provide learning inputs to the participants aiming to remove the informational gaps (awareness), skill gaps (know how) and of lack of motivation on venturing in small scale enterprise. The training and workshop focuses on Differences between business and entrepreneurship, Marketing, production, finance and Financial Analysis. These are the basic knowledge that the participant is important to learn and gain in order to start an enterprise.

According to Mwakio, E. M., (2018) <sup>[15]</sup> that Participants do not need to have had any significant formal education but need to have basic literacy and numeracy skills. A business, also known as an enterprise or a firm, is an organization involved in the trade of goods, services, or both, to consumers with the objective of making a profit. Businesses are prevalent in capitalist economies, where most of them are privately owned and provide goods and services to customers in exchange for other goods, services, or money. In this project participants were trained how to start up a business or enterprise.

### 3.3 Benefits of the training as opined by the respondents

The training and the support extended to the beneficiaries of the project helped improve knowledge and skills of good fish handling, processing, hygiene and sanitation practices; the trainees were able to communicate and identify simple ways to improve tilapia handling, hygiene and sanitation. Further, the beneficiaries were able to plan and prepare simple project proposals, costing of the finished products, and proper recording/bookkeeping of the input and output of their small business enterprise.

The expert/trainers were very keen to spread awareness about tilapia processing. They appreciated the effort of PSU, LGU Sagñay Camarines Sur, Philippines and particularly the support given by the barangay captain of Patitanan in the success of this project. The training was an excellent learning experience for the trainees as well as to the trainers working with the marginalized individuals.

The starter kit that was given to the participants in the form of tools and equipment for the tilapia process is a great help to start for Small and Medium Enterprise (SME).

## 4. LESSON LEARNED

Training is more effective when focused on individual stories, as it is needed when discussing the topics that speak to both the logical and emotional side of bias. Effective Tilapia or fish processing training combines both knowledge and skill. The most difficult skill and knowledge to develop to the trainees are:

A. The food safety and food-hygiene knowledge needed for tilapia which includes:

- a) Knowing that raw meat is likely to be contaminated with dangerous bacteria and that eating undercooked product could result in food poisoning;

- b) Knowing the appropriate cooking time and temperature
  - c) Knowing the correct storage temperatures for both the raw materials and finished products;
  - d) Knowing about other possible sources of cross contamination that might affect the finished product, such as dirty clothes or equipment; AND
  - e) Knowing that hands, gloves, or the equipment used to handle raw materials can contaminate finished products.
- B. The food safety and food hygiene skills needed for tilapia processing which includes:
- a) The skill needed to check the product to make sure that it is cooked thoroughly;
  - b) The skills needed to make sure that equipment is set at the right temperatures;
  - c) The skill to wash hands and equipment to reduce the chances of cross-contamination;
  - d) The skills needed to keep the work area clean; and
  - e) The skills needed to take the right corrective actions when necessary.
- C. Motivating Adult Learners
- As experienced by the experts during the training the effective strategies of motivating adult learners are:
- a) Treating them with respect and flexibility
  - b) Calling the learners by name;
  - c) Clarifying goals and expectations before starting;
  - d) Preparing materials (e.g. have photocopy handouts ready, test audio-visual aids and know the material beforehand);
  - e) Using various learning strategies and adjust them to different situations;
  - f) Giving trainees frequent feedback;
  - g) Asking for feedback during training; and
  - h) Responding to requests and feedback from learners.

## 5. ACKNOWLEDGEMENT

The authors would like to thank the LGU Sagñay for allowing the authors to undergo extension services at Barangay Patinan. Special thanks to all members of ‘Pantawid Pamilyang Pilipino Program” (4Ps) who participated in realizing these extension services.

## REFERENCES

1. PSA,2015. 2015 Full Year Poverty Statistics. <https://psa.gov.ph/psa-press-release-tags/2015-full-year-poverty-statistics>
2. Bigueja, et.al., 2021. Physico, Microbiological and Nutritional Quality of Vacuum Smoked Nile Tilapia (*Oreochromis Niloticus*) in Different Moisture Content at Various Storage Time and Temperature. United International Journal for Research & Technology | Volume 03, Issue 01.
3. Murthy, L.N., Panda, S.K., Shamasundar, B.A.,2011. Physico-chemical and Functional Properties of Proteins of Tilapia (*Oreochromis mossambicus*). Journal of Food Process Engineering 34, 83–107
4. Christoplos, I., et.al., 2019. Building Agricultural Extension Capacity in Post-Conflict Settings. Published by [CAB International](#).
5. Fujita, R., et. Al., (2018). Technologies for Improving Fisheries Monitoring. Environmental Defense Fund, San Francisco. [https://www.edf.org/sites/default/files/oceans/Technologies\\_for\\_Improving\\_Fisheries\\_Monitoring.pdf](https://www.edf.org/sites/default/files/oceans/Technologies_for_Improving_Fisheries_Monitoring.pdf).
6. Luomba, J.O., et.al., (2013) International Journal of Research in Fisheries and Aquaculture Universal Research Publications <https://www.researchgate.net/publication/256477617>.
7. Ahmed, M. et. al., (2021). Socio-Economic Conditions of Small-Scale Hilsa Fishers in the Meghna River Estuary of Chandpur, Bangladesh. Sustainability 13, 12470. <https://doi.org/10.3390/su132212470>.
8. Medard, M. (2004). The contribution of fisheries to the national economy. A paper presented during sensitization workshop of police, judiciary and local administration on fisheries monitoring control and surveillance held from 16th20th February, 2004 in Bukoba, Musoma and Mwanza
9. Onyango, P.O. et.al., (2006). Socio economic baseline survey report. IFMP Technical report.
10. Nowsad, AKM, A. (2013). Advanced Training for Post-harvest Fisheries Management in the Gambia for Minimizing Loss and Maximizing Profit. <https://www.researchgate.net/publication/341998700>
11. Bigueja, et.al., 2020. Nutritional and Sensory Characteristics of Locally Produced Bottled Tilapia (*Oreochromis niloticus*) in Coconut (*Coconuts nucifera L.*) Sauce. International Journal of Life Sciences Research. Vol. 8, Issue 2, pp: (38-45).
12. Guevara, G. and Camu, C. , (1988). The Fish Processing Industry in the Philippines: Status, Problems and Prospects. Country Report: Philippines. Fisheries Utilization Division Bureau of Fisheries & Aquatic Resources Quezon City, Philippines.



13. Dalaguit, M. and Dalaguit, A., (2016). Tilapia (*Oreochromis Niloticus* Peters) Tocino Processing: Technology Transfer. <https://www.researchgate.net/publication/306308596>.
14. Ahmed, O., et.al. (2015). Quality Changes and Microbial Load of Marinated Tilapia (*Oreochromis niloticus*) Stored at Refrigeration Temperature.
15. Roxas, P.t.al, (2018). Building Resilience and Poverty Alleviation Through Tilapia-Based Skills And Livelihood Development In Northern Mindanao. <https://www.researchgate.net/publication/328605788>.
16. Mwakio, E. M., (2018). Business skills and entrepreneurship development training and planning manual. International Potato Center, Lima, Perú.